SCIENCE

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ANTHROPOLOGY PAST AND PRESENT.

IT was forty-four years ago that for the first and for the last time I was able to take an active part in the meetings of the British Association for the Advancement of Science. It was at Oxford, in 1847, when I read a paper on the "Relations of Bengali to the Aryan and Aboriginal Languages of India," which received the honor of being published in full in the "Transactions" of the association for that year. I have often regretted that absence from England and pressure of work have prevented me year after year from participating in the meetings of the association. But, being a citizen of two countries,—of Germany by birth, of England by adoption,—my long vacations have generally drawn me away to the Continent, so that, to my great regret, I found myself precluded from sharing either in your labors or in your delightful social gatherings.

I wonder whether any of those who were present at that brilliant meeting at Oxford in 1847 are present here to-day. I almost doubt it. Our president then was Sir Robert Inglis, who will always be known in the annals of English history as having been preferred to Sir Robert Peel as member of Parliament for the University of Oxford. Among other celebrities of the day I remember Sir Roderick Murchison, Sir David Brewster, Dean Buckland, Sir Charles Lyell, Professor Sedgwick, Professor Owen, and many more—a galaxy of stars, all set or setting. Young Mr. Ruskin acted as secretary to the geological section. Our section was then not even recognized as yet as a section. We ranked as a sub-section only of Section D, Zoology and Botany. We remained in that subordinate position till 1851, when we became Section E, under the name of Geography and Ethnology. From 1869, however, Ethnology seems almost to have disappeared again, being absorbed in Geography, and it was not till the year 1884 that we emerged once more as what we are to-day, Section H, or Anthropology.

In the year 1847 our sub-section was presided over by Professor Wilson, the famous Sanscrit scholar. The most active debaters, so far as I remember, were Dr. Prichard, Dr. Latham, and Mr. Crawfurd, well known then under the name of the Objector-General. I was invited to join the meeting by Bunsen, then Prussian Minister in London, who also brought with him his friend Dr. Karl Meyer, the Celtic scholar. Prince Albert was present at our debates, so was Prince Louis Lucien Bonaparte. Our ethnological sub-section was then most popular, and attracted very large audiences.

When looking once more through the debates carried on in our section in 1847, I was very much surprised when I saw how very like the questions which occupy us to-day are to those which we discussed in 1847. I do not mean to say that there has been no advance in our science. Far from it. The advance of linguistic, ethnological, anthropological, and biological studies, all of which claim a hearing in our section, has been most rapid. Still that advance has been steady and sustained; there has been no cataclysm, no deluge, no break in the advancement of our science, and nothing seems to me to prove its healthy growth more clearly than this uninterrupted continuity, which united the past with the present, and will, I hope, unite the present with the future.

No paper is in that respect more interesting to read than the address which Bunsen prepared for the meeting in 1847, and which you will find in the "Transactions" of that year. Its title is "On the Results of the recent Egyptian Researches in reference to Asiatic and African Ethnology, and the Classification of Languages." But you will find it a great deal more than what this title would lead you to expect.

There are passages in it which are truly prophetic, and which show that, if prophecy is possible anywhere, it is possible, nay, it ought to be possible, in the temple of science, and under the inspiring influence of knowledge and love of truth.

Allow me to dwell for a little while on this remarkable paper. It is true, we have travelled so fast that Bunsen seems almost to belong to ancient history. This very year is the hundredth anniversary of his birth, and this very day the centenary of his birth is being celebrated in several towns of Germany. In England also his memory should not be forgotten. No one, not being an Englishman by birth, could, I believe, have loved this country more warmly, and could have worked more heartily than Bunsen did to bring about that friendship between England and Germany which must forever remain the corner-stone of the peace of Europe, and the *sine quâ non* of that advancement of science to which our association is devoted. His house in Carlton Terrace was a true international academy, open to all who had something to say, something worth listening to, a kind of sanctuary against vulgarity in high places, a neutral ground where the best representatives of all countries were welcome and felt at home. But this also belongs to ancient history. And yet, when we read Bunsen's paper, delivered in 1847, it does not read like ancient history. It deals with the problems which are still in the foreground, and if it could be delivered again to-day by that genial representative of German learning, it would rouse the same interest, provoke the same applause, and possibly the same opposition also, which it roused nearly half a century ago. Let me give you a few instances of what I mean.

We must remember that Darwin's "Origin of Species" was published in 1859, his "Descent of Man" in 1871. But here in the year 1847 one of the burning questions which Bunsen discusses is the question of the possible descent of man from some unknown animal. He traces the history of that question back to Frederick the Great, and quotes his memorable answer to D'Alembert. Frederick the Great, you know, was not disturbed by any qualms of orthodoxy. "In my kingdom," he used to say, "everybody may save his soul according to his own fashion." But when D'Alembert wished him to make what he called the *salto mortale* from monkey to man, Frederick the Great protested. He saw what many have seen since, that there is no possible transition from reasonlessness to reason, and that with all the likeness of their bodily organs there is a barrier which no animal can clear, or which, at all events, no animal has as yet cleared. And what does Bunsen himself consider the real barrier between man and beast? "It is language," he says, "which is unattainable, or, at least, unattained, by any animal except man." In answer to the argument that, given only a sufficient number of years, a transition by imperceptible degrees from animal cries to articulate language is at least conceivable, he says: "Those who hold that opinion have never been able to show the possibility of the first step. They attempt to veil their inability by the easy but fruitless assumption of an infinite space of time, destined to explain the gradual development of animals into men; as if millions of years could supply the want of the agency necessary for the first movement, for the first step, in the line of progress. No numbers can effect a logical impossibility. How, indeed, could reason spring out of a state which is destitute of reason? How can speech, the expression of thought, develop itself, in a year, or in millions of years, out of articulate sounds, which express feelings of pleasure, pain, and appetite?"

He then appeals to Wilhelm von Humboldt, whom he truly calls the greatest and most acute anatomist of almost all human speech.

[1] Address before the section of Anthropology of the British Association for the Advancement of Science, at Cardiff, August, 1891, by Professor F. Max Müller, president of the section (Nature, Sept. 3).

Humboldt goes so far as to say: "Rather than assign to all languages a uniform and mechanical march that would lead them step by step from the grossest beginnings to their highest perfection, I should embrace the opinion of those who ascribe the origin of language to an immediate revelation of the Deity. They recognize at least that divine spark which shines through all idioms, even the most imperfect and the least cultivated."

Bunsen then sums up by saying: "To reproduce Monboddo's theory in our days, after Kant and his followers, is a sorry anachronism, and I therefore regret that so low a view should have been taken of the subject lately in an English work of much correct and comprehensive reflection and research respecting natural science." This remark refers, of course, to the "Vestiges of Creation" (see an article in the *Edinburgh Review*, July, 1845), which was then producing the same commotion which Darwin's "Origin of Species" produced in 1859.

Bunsen was by no means unaware that in the vocal expression of feelings, whether of joy or pain, and in the imitation of external sounds, animals are on a level with man. "I believe with Kant," he says, "that the formation of ideas or notions, embodied in words, presupposes the action of the senses and impressions made by outward objects on the mind. But," he adds, "what enables us to see the genus in the individual, the whole in the many, and to form a word by connecting a subject with a predicate, is the power of the mind, and of this the brute creation exhibits no trace."

You know how for a time, and chiefly owing to Darwin's predominating influence, every conceivable effort was made to reduce the distance which language places between man and beast, and to treat language as a vanishing line in the mental evolution of animal and man. It required some courage at times to stand up against the authority of Darwin, but at present all serious thinkers agree, I believe, with Bunsen, that no animal has developed what we mean by rational language, as distinct from mere utterances of pleasure or pain, from imitation of sounds and from communication by means of various signs, a subject that has lately been treated with great fulness by my learned friend Professor Romanes in his "Mental Evolution of Man." Still, if all true science is based on facts, the fact remains that no animal has ever formed what we mean by a language; and we are fully justified, therefore, in holding with Bunsen and Humboldt, as against Darwin and Professor Romanes, that there is a specific difference between the human animal and all other animals, and that that difference consists in language as the outward manifestation of what the Greeks meant by *Logos*.

Another question which occupies the attention of our leading anthropologists is the proper use to be made of the languages, customs, laws, and religious ideas of so-called savages. Some, as you know, look upon these modern savages as representing human nature in its most primitive state, while others treat them as representing the lowest degeneracy into which human nature may sink. Here, too, we have learned to distinguish. We know that certain races have had a very slow development, and may, therefore, have preserved some traces of those simple institutions which are supposed to be characteristic of primitive life. But we also know that other races have degenerated and are degenerating even now. If we hold that the human race forms but one species, we cannot, of course, admit that the ancestors even of the most savage tribes, say of the Australians, came into the world one day later than the ancestors of the Greeks, or that they passed through fewer evolutions than their more favored brethren. The whole of humanity would be of exactly the same age. But we know its history from a time only when it had probably passed already through many ups and downs. To suppose, therefore, that the modern savage is the nearest approach to primitive man would be against all the rules of reasoning. Because in some countries, and under stress of unfavorable influences, some human tribes have learned to feed on human flesh, it does not follow that our first ancestors were cannibals. And here, too, Bunsen's words have become so strikingly true that I may be allowed to quote them: "The savage is justly disclaimed as the prototype of natural, original man; for linguistic inquiry shows that the languages of savages are degraded and decaying fragments of nobler formations."

I know well that in unreservedly adopting Bunsen's opinion on this point also I run counter to the teaching of such well-known writers as Sir John Lubbock, Reclus, and others. It might be supposed that Mr. Herbert Spencer also looked upon savages as representing the primitive state of mankind. But if he ever did so, he certainly does so no longer, and there is nothing I admire so much in Mr. Herbert Spencer as this simple love of truth, which makes him confess openly whenever he has seen occasion to change his views. "What terms and what conceptions are truly primitive," he writes, "would be easy if we had an account of truly primitive men. But there are sundry reasons for suspecting that existing men of the lowest type forming social groups of the simplest kind do not exemplify men as they originally were. Probably most of them, if not all, had ancestors in a higher state" (*Open Court*, No. 205, p. 2896).

Most important also is a hint which Bunsen gives that the students of language should follow the same method which has been followed with so much success in geology; that they should begin with studying the modern strata of speech, and then apply the principles, discovered there, to the lower or less accessible strata. It is true that the same suggestion had been made by Leibnitz, but many suggestions are made and are forgotten again, and the merit of rediscovering an old truth is often as great as the discovery of a new truth. This is what Bunsen said: "In order to arrive at the law which we are endeavoring to find (the law of the development of language) let us first assume, as geology does, that the same principles which we see working in the (recent) development were also at work at the very beginning, modified in degree and in form, but essentially the same in kind." We know how fruitful this suggestion has proved, and how much light an accurate study of modern languages and of spoken dialects has thrown on some of the darkest problems of the science of language. But fifty years ago it was Sanscrit only, or Hebrew, or Chinese, that seemed to deserve the attention of the students of comparative philology. Still more important is Bunsen's next remark, that language begins with the sentence, and that in the beginning each word was a sentence in itself. This view also has found strong supporters at a later time, — for instance, my friend Professor Sayce, — though at the time we are speaking of it was hardly thought of. I must here once more quote Bunsen's own words: "The supreme law of progress in all language shows itself to be the progress from the substantial isolated word, as an undeveloped expression of a whole sentence, towards such a construction of language as makes every single word subservient to the general idea of a sentence, and shapes, modifies, and dissolves it accordingly." And again: "Every sound in language must originally have been significative of something. The unity of sound (the syllable, pure or consonantized) must therefore originally have corresponded to a unity of conscious plastic thought, and every thought must have had a real or substantial object of perception. . . . Every single word implies necessarily a complete proposition, consisting of subject, predicate, and copula."

This is a most pregnant remark. It shows as clearly as daylight the enormous difference there is between the mere utterance of the sound *Pah* and *Mah*, as a cry of pleasure or distress, and the pronunciation of the same syllable as a sentence, when *Pah* and *Mah* are meant for "This is *Pah*," "This is *Mah*;" or, after a still more characteristic advance of the human intellect, "This is *a Pah*," "This is *a Mah*," which is not very far from saying, "This man belongs to the class or genus of fathers."

Equally important is Bunsen's categorical statement that everything in language must have been originally significant, that everything formal must originally have been substantial. You know what a bone of contention this has been of late between what is called the old school and the new school of comparative philology. The old school maintained that every word consisted of a root and of certain derivative suffixes, prefixes, and infixes. The modern school maintained that there existed neither roots by themselves nor suffixes, prefixes, and infixes by themselves, and that the theory of agglutination — of gluing suffixes to roots — was absurd. The old school looked upon these suffixes as originally independent and significative words; the modern school declined to accept this view except in a few irrefragable instance

I think the more accurate reasoners are coming back to the opinion held by the old school, that all formal elements of language were originally substantial, and therefore significative; that they are the remnants of predicative or demonstrative words. It is true that we cannot always prove this as clearly as in the case of such words as *hard-ship, wis-dom, man-hood,* where *hood* can be traced back to *hád,* which in Anglo-Saxon exists as an independent word, meaning state or quality. Nor do we often find that a suffix like *mente* in *claramente, clairemente,* continues to exist by itself, as when we say in Spanish *clara, concisa y elegantemente.* It is perfectly true that the French, when they say that a hammer falls *lourdement,* or heavily, do not deliberately take the suffix *ment* — originally the Latin *mente,* "with a mind" — and glue it to their adjective *lourd.* Here the new school has done good service in showing the working of that instinct of analogy which is a most important element in the historical development of human speech. One compound was formed in which *mente* retained its own meaning; for instance, *forti mente,* "with a brave mind." But when this had come to mean *bravely,* and no more, the working of analogy began; and if *fortement,* from *fort,* could mean "bravely," then why not *lourdement,* from *lourd,* "heavily?" But in the end there is no escape from Bunsen's fundamental principle that everything in language was originally language — that is, was significative, was substantial, was material — before it became purely formal.

But it is not only with regard to these general problems that Bunsen has anticipated the verdict of our own time. Some of his answers to more special questions also show that he was right when many of his contemporaries, and even successors, were wrong. It has long been a question, for instance, whether the Armenian language belonged to the Iranic branch of the Aryan family, or whether it formed an independent branch, like Sanscrit, Persian, or Greek. Bunsen, in 1847, treated Armenian as a separate branch of Aryan speech; and that it is so was proved by Professor Hübschmann in 1883.

Again, there has been a long controversy whether the language of the Afghans belonged to the Indic or the Iranic branch. Dr. Trumpp tried to show that it belonged, by certain peculiarities, to the Indic or Sanscrit branch. Professor Darmsteter has proved but lately that it shares its most essential characteristics in common with Persian. Here, too, Bunsen guessed rightly — for I do not mean to say that it was more than a guess — when he stated that "Pushtu, the language of the Afghans, belongs to the Persian branch."

I hope you will forgive me for having detained you so long with a mere retrospect. I could not deny myself the satisfaction of paying this tribute of gratitude and respect to my departed friend Baron Bunsen. To have known him belongs to the most cherished recollections of my life. But though I am myself an old man,— much older than Bunsen was at our meeting in 1847,— do not suppose that I came here as a mere *laudator temporis acti.* Certainly not. If one tries to recall what anthropology was in 1847, and then considers what it is now, its progress seems most marvellous. I do not think so much of the new materials which have been collected from all parts of the world. These last fifty years have been an age of discovery in Africa, in central Asia, in America, in Polynesia, and in Australia, such as can hardly be matched in any previous century.

But what seems to me even more important than the mere increase of material is the new spirit in which anthropology has been studied during the last generation. I do not mean to depreciate the labors of the so-called *dilettanti.* After all, *dilettanti* are lovers of knowledge, and in a study such as the study of anthropology the labors of these volunteers, or *franc-tireurs,* have often proved most valuable. But the study of man in every part of the world has ceased to be a subject for curiosity only. It has been raised to the dignity, but also to the responsibility, of a real science, and it is now guided by principles as strict and as rigorous as any other science — such as zoology, botany, mineralogy, and all the rest. Many theories which were very popular fifty years ago are now completely exploded; nay, some of the very principles by which our science was then guided have been discarded. Let me give you one more instance — perhaps the most important one — as determining the right direction of anthropological studies.

At our meeting in 1847 it was taken for granted that the study of comparative philology would be in future the only safe foundation for the study of anthropology. Linguistic ethnology was a very favorite term used by Bunsen, Prichard, Latham, and others. It was, in fact, the chief purpose of Bunsen's paper to show that the whole of mankind could be classified according to language. I protested against this view at the time, and in 1854 I published my formal protest in a letter to Bunsen, "On the Turanian Languages." In a chapter called "Ethnology *versus* Phonology" I called, if not for a complete divorce, at least for a judicial separation between the study of philology and the study of ethnology. "Ethnological race," I said, "and phonological race are not commensurate, except in ante-historical times, or, perhaps, at the very dawn of history. With the migration of tribes, their wars, their colonies, their conquests and alliances, which, if we may judge from their effects, must have been much more violent in the ethnic than ever in the political periods of history, it is impossible to imagine that race and language should continue to run parallel. The physiologist should pursue his own science, unconcerned about language. Let him see how far the skulls, or the hair, or the color of the skin, of different tribes admits of classification; but to the sound of their words his ear should be as deaf as that of the ornithologist's to the notes of caged birds. If his Caucasian class includes nations or individuals speaking Aryan (Greek), Turanian (Turkish), and Semitic (Hebrew) languages, it is not his fault. His system must not be altered to suit another system. There is a better solution both for his difficulties and for those of the phonologist than mutual compromise. The phonologist should collect his evidence, arrange his classes, divide and combine as if no Blumenbach had ever looked at skulls, as if no Camper had ever measured facial angles, as if no Owen had ever examined the basis of a cranium. His evidence is the evidence of language, and nothing else; this he must follow, even though in the teeth of history, physical or political. . . . There ought to be no compromise between ethnological and phonological science. It is only by stating the glaring contradictions between the two that truth can be elicited."

At first my protest met with no response; nay, curiously enough, I have often been supposed to be the strongest advocate of the theory which I so fiercely attacked. Perhaps I was not entirely without blame, for, having once delivered my soul, I allowed myself occasionally the freedom to speak of the Aryan or the Semitic race, meaning thereby no more than the people, whoever and whatever they were, who spoke Aryan or Semitic languages. I wish we could distinguish in English as in Hebrew between *nations* and *languages.* Thus in the Book of Daniel, iii. 4, "the herald cried aloud, . . . O people, nations, and languages." Why then should we not distinguish between nations and languages? But to put an end to every possible misunderstanding, I declared at last that to speak of "an Aryan skull would be as great a monstrosity as to speak of a dolichocephalic language."

I do not mean to say that this old heresy, which went by the name of linguistic ethnology, is at present entirely extinct. But among all serious students, whether physiologists or philologists, it is by this time recognized that the divorce between ethnology and philology, granted if only for incompatibility of temper, has been productive of nothing but good.

Instead of attempting to classify mankind as a whole, students are now engaged in classing skulls, in classing hair, and teeth, and skin. Many solid results have been secured by these special researches; but, as yet, no two classifications, based on these characteristics, have been made to run parallel.

The most natural classification is, no doubt, that according to the color of the skin. This gives us a black, a brown, a yellow, a red, and a white race, with several subdivisions. This classification has often been despised as unscientific; but it may still turn out far more valuable than is at present supposed.

The next classification is that by the color of the eyes, as black, brown, hazel, gray, and blue. This subject also has attracted much attention of late, and, within certain limits, the results have proved very valuable.

The most favorite classification, however, has always been that according to the skulls. The skull, as the shell of the brain, has by many students been supposed to betray something of the spiritual essence of man; and who can doubt that the general features of the skull, if taken in large averages, do correspond to the general features of human character? We have only to look round to see men with heads like a cannon-ball and others with heads like a hawk. This distinction has formed the foundation for a more scientific classification into brachycephalic, dolichocephalic, and mesocephalic skulls. The proportion of 80:100 between the transverse and longitudinal diameter gives us the ordinary or mesocephalic type, the proportion of 75:100 the dolichocephalic, the proportion of 85:100 the brachycephalic type. The extremes are 70:100 and 90:100.

If we examine any large collection of skulls, we have not much difficulty in arranging them under these classes; but if, after we have done this, we look at the nationality of each skull, we find the most hopeless confusion. Pruner Bey, as Peschel tells us in his "Volkerkunde," has observed brachycephalic and dolichocephalic skulls in children born of the same mother; and if we consider how many women have been carried away into captivity by Mongolians in their inroads into China, India, and Germany, we cannot feel surprised if we find some longheads among the roundheads of those Central Asiatic hordes. Only we must not adopt the easy expedient of certain anthropologists who, when they find dolichocephalic and brachycephalic skulls in the same tomb, at once jump to the conclusion that they must have belonged to two different races. When, for instance, two dolichocephalic and three brachycephalic skulls were discovered in the same tomb at Alexanderpol, we were told at once that this proved nothing as to the simultaneous occurrence of different skulls in the same family: nay, that it proved the very contrary of what it might seem to prove. It was clear, we were assured, that the two dolichocephalic skulls belonged to Aryan chiefs and the three brachycephalic skulls to their non-Aryan slaves, who were killed and buried with their masters, according to a custom well known to Herodotus. This sounds very learned, but is it really quite straightforward?

Besides the general division of skulls into dolichocephalic, brachycephalic, and mesocephalic, other divisions have been undertaken, according to the height of the skull, and, again, according to the maxillary and the facial angles. This latter division gives us orthognathic, prognathic, and mesognathic skulls.

Lastly, according to the peculiar character of the hair, we may distinguish two great divisions, the people with woolly hair (Ulotriches) and people with smooth hair (Lissotriches). The former are subdivided into Lophocomi, people with tufts of hair, and Eriocomi, people with fleecy hair. The latter are divided into Euthycomi, straight-haired, and Euplocomi (not Euplocomic, wavy-haired, as Brinton gives it), wavy-haired. It has been shown that these peculiarities of the hair depend on the peculiar form of the hair-tubes, which, in cross-sections, are found to be either round or elongated in different ways.

Now all these classifications, to which several more might be added, those according to the orbits of the eyes, the outlines of the nose, the width of the pelvis, are by themselves extremely useful. But few of them only, if any, run strictly parallel. It has been said that all dolichocephalic races are prognathic, and have woolly hair. I doubt whether this is true without exception; but, even if it were, it would not allow us to draw any genealogical conclusions from it, because there are certainly many dolichocephalic people who are not woolly-haired, as, for instance, the Eskimos (Brinton's "Races and Peoples," p. 249).

Now, let us consider whether there can be any organic connection between the shape of the skull, the facial angle, the conformation of the hair, or the color of the skin, on one side, and what we call the great families of language on the other. That we speak at all may rightly be called a work of nature, *opera naturale*, as Dante said long ago; but that we speak thus or thus, *cosi o cosi*, that, as the same Dante said, depends on our pleasure — that is our work. To imagine, therefore, that as a matter of necessity, or as a matter of fact, dolichocephalic skulls have anything to do with Aryan, mesocephalic with Semitic, or brachycephalic with Turanian speech, is nothing but the wildest random thought; it can convey no rational meaning whatever. We might as well say that all painters are dolichocephalic, and all musicians brachycephalic, or that all lophocomic tribes work in gold, and all lissocomic tribes in silver.

If anything must be ascribed to prehistoric times, surely the differentiation of the human skull, the human hair, and the human skin, would have to be ascribed to that distant period. No one, I believe, has ever maintained that a mesocephalic skull was split or differentiated into a dolichocephalic and a brachycephalic variety in the bright sunshine of history.

But let us, for the sake of argument, assume that in prehistoric times all dolichocephalic people spoke Aryan, all mesocephalic, Semitic, all brachycephalic, Turanian languages; how would that help us?

So long as we know anything of the ancient Aryan, Semitic, and Turanian languages, we find foreign words in each of them. This proves a very close and historical contact between them. For instance, in Babylonian texts of 3000 B.C. there is the word *sindhu* for cloth made of vegetable fibres, linen. That can only be the Sanscrit *sindhu*, the Indus, or *saindhava*, what comes from the Indus. It would be the same word as the Homeric σινδών, fine cloth ("Physical Religion," p. 87). In Egyptian we find so many Semitic words that it is difficult to say whether they were borrowed or derived from a common source. I confess I am not convinced, but Egyptologists of high authority assure us that the names of several Aryan peoples, such as the Sicilians, and Sardinians, occur in the fourteenth century B.C., in the inscriptions of the time of Menephthah I. Again, as soon as we know anything of the Turanian languages — Finnish, for instance — we find them full of Aryan words. All this, it may be said, applies to a very recent period in the ancient history of humanity. Still, we have no access to earlier documents, and we may fairly say that this close contact which existed then existed, probably, at an earlier time also.

If, then, we have no reason to doubt that the ancestors of the people speaking Aryan, Semitic, and Turanian languages, lived in close proximity, would there not have been marriages between them so long as they lived in peace, and would they not have killed the men and carried off the women in time of war? What, then, would have been the effect of a marriage between a dolichocephalic mother and a brachycephalic father? The materials for studying this question of *metissage*, as the French call it, are too scanty as yet to enable us to speak with confidence. But whether the paternal or maternal type prevailed, or whether their union gave rise to a new permanent variety, still it stands to reason that the children of a dolichocephalic captive woman might be found, after fifty or sixty years, speaking the language of the brachycephalic conquerors.

(To be continued.)

NOTES AND NEWS.

FROM an experiment reported in Bulletin No. 35 of the Kentucky Experiment Station, which is located in the heart of the Blue Grass region at Lexington, it appears that the results are the same as they have been for the last two seasons, that fertilizers, whether used in combination or singly, have no effect upon the yield of wheat. On the same lands, for corn, potatoes, hemp, and tobacco, the results of potash fertilizers show very favorably.

— Sr. H. Morize, astronomer at the observatory of Rio de Janeiro, has just published a "Sketch of the Climatology of Brazil," which will be welcome to meteorologists, as hitherto systematic observations have only been published for a very few points of that immense country, covering 39 degrees of latitude. The sketch has been drawn up mainly from the observations of travellers and private observers. *Nature* extracts a few brief notes from the sketch, as follows. Thunder-storms are very frequent all along the coast, and are mostly harmless; regular cyclones are very rare. The most dangerous winds are the pamperos, which blow from the south-west, and have been fully described by the late Admiral Fitz-Roy, and a still more rare and dangerous wind which blows from the south-east. As regards temperature, the

author has divided the country into three zones, and some valuable data are given for various localities. Parts of the country are subject to prolonged drought; it is said that at Pernambuco no rain fell during the whole year 1792, and a third of the population died from its effects; droughts have recurred during the present century with some regularity, the last being in the year 1888–89. The most complete series of observations is that for Rio de Janeiro, which dates from 1781, with occasional interruptions. The highest shade temperature was 99.5° in November, 1883, and the lowest 50.4° in September, 1882. There are also good series of observations for Rio Grande do Sul and São-Paulo.

—A recent calf-feeding experiment made at the Iowa Agricultural Experiment Station seems to indicate that (1) a ration of skim milk and ground flaxseed compares favorably with a new-milk ration for young calves; (2) the larger gain came from the whole milk, but a part of it was partly due to the individuality of the calves, and good results and thrifty growth were made on skim milk and ground flaxseed; (3) the skim-milk calves were interrupted less in their growth by weaning than the whole milk calves; (4) a saving in value of butter fat alone of $1.11 per month on each calf was effected by substituting the ground flaxseed; and (5) the cost of producing a pound of gain was 7.6 cents for the fresh-milk ration and 5 cents for the skim-milk ration.

— According to *Nature*, M. Lancaster has recently indicated in *Ciel et Terre* the divergences from normal temperature in Europe in the five years 1886–90. It appears (and is shown in a map) that the centre of the "island of cold" lies over the north of France, the south of Belgium, and the most western parts of Germany. From this centre the cold decreases pretty regularly outwards on all sides to a nearly circular line of *nil* divergence, which, embracing the whole of Great Britain, crosses the south of Sweden, then goes along the German-Russian frontier, through Hungary, the south of Italy, the north of Africa, and across Spain. Throughout this inclosed region abnormally low temperatures have prevailed. Siberia, too, shows thermal depression, which M. Lancaster thinks may be connected with that in western Europe.

— In *Nature Notes* for August, Mr. R. T. Lewis, on the authority of a correspondent in whose trustworthiness he has entire confidence, gives a curious account of the appreciation with which the song of the cicada is heard by insects other than those of its own genus. The correspondent has frequently observed in Natal, says *Nature*, that when the cicada is singing at its loudest, in the hottest portion of the day, it is attended by a number of other insects with lovely, gauze like, irridescent wings, whose demeanor has left no doubt on his mind that the music is the attraction. The cicada, when singing, usually stations itself upon the trunk of a tree with its head uppermost, and the insects in question, to the number sometimes of fifteen or sixteen, form themselves into a rough semicircle at a short distance around its head. During a performance one of the insects was observed occasionally to approach the cicada and to touch it upon its front leg or antennæ, which proceeding was resented by a vigorous stroke of the foot by the cicada, without, however, any cessation of its song. The insects composing the audience are extremely active; and so wary that they take flight at the least alarm on the too near approach of any intruder. Some of them, however, have been captured; and on examination these "proved to belong to the same family as the most beautiful of British insects, the lace-wing fly, which, indeed, they closely resemble except as to size, their measurement across the expanded wings being a little over two inches. They have since been identified by Mr. Kirby at the British Museum as *Nothochrysa gigantea*."

— An experiment to test the effect of feed on the quality of milk, recently made at the Iowa Experiment Station, indicates that: (1) quality of milk, so far as measured by its percentage of fat, was changed by feed to a much greater degree than was quantity. Two-thirds of the increase in average gross yield of butter fat was due to improved quality of the milk, and only one-third to increased milk flow. (2) Sugar meal produced .58 of a pound more butter fat per 100 pounds of milk than did corn and cob meal; this difference is seventeen per cent of the amount of fat in 100 pounds of milk produced by corn and cob meal. (3) Sugar meal produced .73 of a pound more total solids per 100 pounds of milk than did corn and cob meal; this difference is six per cent of the solids in 100 pounds of milk produced by corn and cob meal. (4) As compared with corn and cob meal, sugar meal increased the ratio of fat to "solids not fat" in 100 pounds of milk, from 396 per 1,000 of "solids not fat," to 457 per 1,000 of "solids not fat" an increase of over fifteen per cent.

— Under the heading "Breeding of Orchard and Garden Fruits" attention is directed in a recent bulletin of the Iowa Agricultural Experiment Station to the following well supported facts: (1) In the States west of Lake Michigan no important advances have been made in the great work of adapting fruits to the peculiar climate and soil of Iowa by growing seedlings from the variety introduced from south-western Europe, nor from their seedlings originating in the Eastern or Southern States. (2) Valuable seedlings of the orchard and garden fruits have come from the varieties introduced from eastern Europe or northern Asia, and from native species. (3) Methodic crossing and hybridizing have given in the past, and promise to give in the near future, more valuable and certain results than can be hoped for from chance breeding from intermingled varieties and species.

— We learn from the Tiflis paper *Caucasus*, says *Nature*, that during an excursion to the sources of the Jiagdon, which was made recently by several explorers, no fewer than eight glaciers were discovered, six of which are not marked on the five-versts-to-the-inch map of Caucasus. They have been viewed now and sketched from Styr-khokh Pass. The southern slope of the branch-ridge of the main chain, between the Kazbek and the Syrkhubarzon peak, has also been sketched from the Trussoff's Pass, and it appears that several of the glaciers of this part of the chain are not represented on the great map, while perpetual snow is shown where there is none. The glaciers visited by the party proved to have very much changed their aspect since 1882. Several sulphur and iron carbonate springs were visited in the Trussoff's valley, and several interesting Alpine flowers in bloom were collected on the passes.

— It is well known that the fox possesses an excellent "head for country." Referring to this subject in an interesting article in the current number of the *Zoologist*, and quoted in *Nature*, Mr. Harting says a fox has been known to return seventy miles to his "earth," and this not once, but three times. He was caught in Yorkshire, and sent into Lancashire to be hunted by the hounds of the late Mr. Fitzherbert Brockholes of Claughton Hall, Garstang, and his identity was established by his having been marked in the ear by the fox-catcher. This story Mr. Harting had from his friend Captain F. H. Salvin, who was living in Yorkshire at the time, and was well acquainted with Mr. Brockholes, who gave him all the details.

— The following are some results of Herren Elster and Geitel's recent electric observations on the Sonnblick, described to the Vienna Academy, and noted in *Nature* of Sept. 10: The intensity of the most refrangible solar rays, measured by their discharging effect on a negatively electrified surface of amalgamated zinc, is about doubled on rising 3,100 metres from the lowland. The authors were unable to find other actino-electrically active substances; even pure fresh snow and dry Sonnblick rock were not perceptibly discharged by light. Waterfalls may produce in a valley a negative fall of potential, and to considerable heights (500 metres). The morning maximum in fall of potential, observed regularly between 7 and 9 A.M. in the plain and in Alpine valleys, was absent at 3,100 metres. Before thunder-storms in July, the positive fall of potential sank gradually, in light showers, to *nil*, at which it remained sometimes two or three hours till completion of the electrical process in the cloud. In thunder-clouds, or on low ground, during a thunder-storm, the atmospheric electricity usually changes sign after a discharge. St. Elmo's fire (negative as often as positive) always accompanied thunder-storms. The observation that negative St. Elmo's fire burns with blue flame, positive with red, was repeatedly confirmed.

— Professor Erwin H. Barbour, formerly of Iowa College, Grinnell, Io., has been elected to the chair of geology at the University of Nebraska, Lincoln, Neb.

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Attention is called to the "Wants" column. All are invited to use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

ELECTRO-HORTICULTURE.

IN the winter of 1889-90 experiments were undertaken at the Cornell University Experiment Station, by Professor L. H. Bailey, to determine what influence the ordinary street electric light exerts upon plants in greenhouses. Much has been said among gardeners concerning supposed retarding or accelerating influences of street lamps upon plants. Many have supposed that the electric light can be introduced profitably into greenhouses for the purpose of hastening growth. Still others have supposed the electric lights at exhibition halls to be injurious to plants, and have said that flowers fade quickly when placed near them. The whole subject of the relation of electric light to vegetation should be understood, and wholly aside from any thought of introducing the light into greenhouses, its influence upon plants, both under glass roofs and in the open, is a question which demands careful investigation.

In recapitulating the results of the experiments made, Professor Bailey says, in Bulletin 30 of the station, that it is impossible to draw many definite conclusions from the researches made. The many conflicting and indefinite results indicate that the problems vary widely under different conditions and with different plants. Yet there are a few points which are clear: the electric light promotes assimilation, it often hastens growth and maturity, it is capable of producing natural flavors and colors in fruits, it often intensifies colors of flowers and sometimes increases the production of flowers. The experiments show that periods of darkness are not necessary to the growth and development of plants. There is every reason, therefore, to suppose that the electric light can be profitably used in the growing of plants. It is only necessary to overcome the difficulties, the chief of which are the injurious influences upon plants near the light, the too rapid hastening of maturity in some species, and, in short, the whole series of practical adjustments of conditions to individual circumstances. Thus far, to be sure, more of the injurious effects than of the beneficial ones have been learned, but this only means that definite facts concerning the whole influence of electric light upon vegetation are being acquired; and in some cases the light has already been found to be a useful adjunct to forcing establishments.

The experiments suggest many physiological speculations, three of which may be mentioned. It is a common notion that plants need rest at night, but this is not true, in the sense in which animals need rest. Plants have simply adapted themselves to the conditions of alternating daylight and darkness, and during the day they assimilate or make their food, and during the night, when, perforce, assimilation must cease, they use the food in growth. They simply practice an individual division of labor. There is no inherent reason why plants cannot grow in full light, and, in fact, it is well known that they do grow then, although the greater part of growth is usually performed at night. If light is continuous, they simply grow more or less continuously, as conditions require, as they do in the long days of the arctic regions, or as the plants experimented with did under continuous light. There is no such thing as a plant becoming worn out or tired out because of the stimulating influence of continuous light.

It would seem, therefore, that if the electric light enables plants to assimilate during the night, and does not interfere with growth, it must produce plants of great size and marked precocity. But there are other conditions, not yet understood, which must be studied. The radish plants, and many others, were earlier but smaller under the influence of the light. Observation and chemical examination showed that a greater degree of maturity had been attained. Perhaps they assimilated too rapidly; perhaps the functions of the plant had been completed before it had had time to make its accustomed growth. Perhaps the highly refrangible and invisible rays from the electric lamp have something to do with it. In fact, this latter presumption probably accounts for much, if not all, of the injury resulting from the use of the naked light, for the effect of the interposition of a clear pane of glass is probably to absorb or obstruct these rays of high refrangibility. Good results which follow the use of a globe or a pane of glass show, on the other hand, that the injury to plants cannot result from any gases arising from the lamp itself, as has been supposed by some observers. In the experiments there was no perceptible odor from the gases of combustion; and it may also be said that commercial forcing-houses are not tight enough to hold sufficient quantities of these gases to injure plants.

It is highly probable that there are certain times in the life of the plant when the electric light will prove to be particularly helpful. Many experiments show that injury follows its use at that critical time when the plantlet is losing its support from the seed and is beginning to shift for itself, and other experiments show that good results follow its later use.

HEALTH MATTERS.

Physiology of the Gastric Glands.

ACCORDING to Heidenheim, the delomorphous or parietal cells of the gastric glands — that is, the glands of the fundus — secrete or elaborate the hydrochloric acid of the gastric juice, while the adelomorphous or central cells secrete the pepsin (*British Med. Jour.*). One of the chief arguments advanced in favor of this view rests on the experiments of Swiecicki, who asserted that in the œsophageal glands of the frog pepsin alone is formed, while only hydrochloric acid is formed in the stomach. Fränkel has submitted the statements of Swiecicki to a renewed test. He prepared the mucous membrane of (1) the œsophagus, and (2) the fundus of the stomach of ten frogs, and extracted each separately in two litres of water. To eighteen centimetres of the watery extract of each there were added two centimetres of a one per cent dilution of hydrochloric acid, and a small piece of fibrine. Both mixtures were kept at 37° C. for twenty-four hours; both extracts digested the fibrine. It would seem, therefore, that both the œsophagus and stomach of the frog contain pepsin, or rather, pepsinogen. This would tend to show that in the frog the delomorphous cells secrete both pepsin and acid, for fibrine is digested in the stomach when the secretion from the œsophagus is prevented from entering that organ. Fränkel found that the mucous membrane both of the stomach and œsophagus produced a mineral acid, for both gave the phloro-glucin-vanillin reaction. Contejean finds that section of the vagi does not interfere with gastric digestion in the frog. Electrical stimulation of the peripheral end of the vagus, or of the central ends of the vagus or glosso-pharyn-

geal, causes a copious secretion of mucus. In the last case there is no secretion of mucus when the vagi are divided. Perhaps the result is due to a reflex secretion, the reflex centre being in the bulb, while the vagus is the efferent channel for the impulses affecting the secretory glands. In birds also it would appear that the vagus influences the secretion of gastric juice. Oxenfeld finds that in birds (pigeons) stimulation of the peripheral end of the vagus is followed by a copious secretion of acid gastric juice. At the same time the stomach is forcibly contracted, and it might be assumed that the increased quantity of gastric juice was simply forced out of the glands by the concentration of the musculature of the stomach. Oxenfeld, however, is of opinion that this is not the true explanation, and he assumes that the vagus contains secretory fibres for the gastric glands.

LETTERS TO THE EDITOR.

*** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

The editor will be glad to publish any queries consonant with the character of the journal.

How Children Learn to Talk.—A Study in the Development of Language.—Children's Vocabularies.

PHILOLOGISTS and others interested in the origin of language and the development of intellect find very striking analogies between the development of speech and intelligence in the race and in the child, and have obtained some very valuable hints as to the laws determining the growth of language. Scientific psychologists and educators have also gained many important truths from the study of children. A much more extensive and detailed study, however, is now necessary to further progress in either line.

The first thing to be done in every scientific investigation is to collect a large number of reliable facts, from which generalizations may be made and theories found that will guide the investigator in further researches, and lead to the discovery and unification of a general law of nature that can usually be turned to practical account by the inventor, educator, or legislator. Facts of every kind in regard to development of intelligence in children and their progress in language are important, and in the earlier stages of the investigation the common and ordinary facts rather than the unusual and extraordinary are the most valuable. For the purpose of securing such facts and arousing interest in the study of children I wrote an article some months ago entitled "Children as Teachers," and published it in a number of papers. The records sent me in response to the request in that article are very interesting and suggestive. Many interested in the subject, however, doubtless overestimated the difficulty of securing valuable records, and therefore I have not yet received a sufficient number of records to justify me in making a full report, as I had promised, at present. The records so far examined serve to bring out the great individual differences in children rather than to show what is common to all, yet they are common characteristics suggestive of general laws sufficient to confirm me in the belief that a comparison of a number of such records will give very valuable results.

A convenient method for those who cannot keep a daily record of a child's progress in language was adopted by some reporting to me. During a certain period special attention was paid to the child's language, and all words the child was known to use understandingly were noted down in alphabetical order (the child's pronunciation of the words being indicated as nearly as possible), and this was taken as the child's vocabulary at that age. A few months later the process was repeated, and the progress that had been made could then readily be seen by comparing the two records.

The number of words used by children two years old differs considerably, but is usually larger than parents supposed. The number varies from a very few words for the child who is backward in learning to talk, though perhaps not less intelligent otherwise, up to a thousand words for children more precocious in that particular. Judging from the records in my possession, from two to four hundred words is the more common number.

The rate at which new words are acquired varies greatly for different children and at different ages. After they are once fairly started in learning language, it is usually quite rapid, especially with those who are late in beginning to talk. For children just past two years of age, from sixty to one hundred words per month seems to be a common number. If new words should continue to be acquired at this rate until maturity, as they probably are by those who study and read much, an adult would have a vocabulary of from 15,000 to 25,000 words (see "Size of an Ordinary Vocabulary," *Science*, Aug. 21, 1891). The additional words used by a child do not represent all of his progress in language. He may have learned the meaning of many words he has had no occasion to use; he may have learned something about forming plurals and the different parts of verbs, and considerable about how to put words together in sentences. The progress in the latter respect may be shown by keeping a record of his characteristic attempts at sentence making, being careful to omit sentences that are evidently repeated from memory.

The part of speech most used by children seems to be the noun. About 60 per cent of the words in the English language are nouns, 22 per cent adjectives, 11 per cent verbs, and 5½ per cent adverbs, while conjunctions, prepositions, and pronouns form but an insignificant portion of the whole. In an ordinary vocabulary, taking "Robinson Crusoe" as the standard, the proportion of nouns is smaller, and in a still smaller vocabulary there seems to be occasion for the use of a greater variety of verbs than nouns, and a necessity for the use of a number of prepositions, pronouns, and conjunctions. On a page of "Robinson Crusoe" containing 215 different words, but 24 per cent were nouns. Hence the fact that in a child's vocabulary of a few hundred words from 55 to 85 per cent of them are nouns, while but few of the prepositions, pronouns, and conjunctions that it hears repeated so frequently are used, is quite significant. Nouns, however, are not always learned easier and earlier than other parts of speech, for such a verb as "come," or adjective as "hot," may be among the first words learned. Any word which can be associated with a distinct, sensible experience can readily be learned, but abstract terms are not found in children's vocabularies.

General terms are used by children, at quite an early age, with some degree of correctness, though of course all that is connotated or included under a general term is not understood by any one until its scientific meaning is known. A general term is applied to all individuals having certain characteristics, though they may differ in other respects. The accuracy with which a child uses general terms depends upon the distinctness of his ideas of the special characteristics to which the term is applied, and his power of noting and discriminating those special qualities among a variety of others. His attainments in these two respects are limited by his previous experience. A child who calls a goat a "dog" may lack in clearness of conception of the characteristics of dogs, or in his powers of discrimination, or only in experience. In the latter case he classifies it with the group of animals it resembles more closely than any others with which he is acquainted. A child of twenty-six months who found a small crab in her oyster soup classified it at once with the group of animals it seemed to her to most resemble, and called it a "bug," then performing a considerable act of inference, she gave it the more definite name "oyster-bug." A little girl of less than eighteen months, who learned the word "cut" in connection with the use of a knife, not only called all knives "cutie," but applied the same term to shears when she saw the same operation performed with them, and later to a sickle with which grass was being cut. Nothing is more interesting or important in the study of children than the way in which they generalize, classify, and infer, and instances of such childish judgments and inferences, so odd to us, yet really so natural and logical from their point of view, should be carefully noted and recorded.

Children sometimes form a language of their own entirely different from that of their parents. This is more likely to occur with children of the same age, especially if they are alone together much. Instances are known of children forming apparently quite

complete vocabularies, and using no other for several years. This tendency to originate language is shown in almost every child by the invention of new words or new uses for words. New terms are often formed by imitating the noise made by the animal or thing named, as "bow-wow" for dog, "choo-choo" for locomotive, and sometimes by the repetition of a sound made in performing an act, or an emotional sound made at sight of a new object or act. Any sound thus associated with an object, act, quality, or state of feeling may be used by the child as a word, and, if the parents or playmates accept it as having a certain significance, it becomes fixed as a permanent part of the child's vocabulary.

Baby talk, or the peculiar pronunciation used by children, and frequently imitated in literature, is a subject of considerable interest. How much of what is given as "baby talk" has really been originated by children? How much of the incorrect pronunciation of any particular child is due to his inability to pronounce correctly, and how much to the foolish habit of mispronouncing words when speaking to children practised by so many fond parents? Of still more importance is it to know whether there really is any general law of mispronunciation that may be of practical value to the educator. In only a part of the records sent me was the pronunciation used by the child indicated, hence only the probabilities in regard to the law can be given. In the first place, it must be understood that the ability to pronounce words is entirely independent of the ability to understand their meaning, and either capacity may be developed in advance of the other. However, in the acquirement of new words, difficulty of pronunciation may exercise some influence in preventing the adoption of certain words into the vocabulary. Not all children are influenced in this way; some adopt difficult words but use a sound easily pronounced in place of the one they cannot pronounce, sometimes following a regular system of substitution. The law of mispronunciation proposed by Noble (*Education*, 1888) seems theoretically quite probable, and some of the facts support it, but not enough have been collected to establish it. He reasons that correct pronunciation depends upon clear perception of the sounds to be uttered and a knowledge of the motions necessary to produce them. The knowledge of the proper movements to be made are partly gained by watching the motions made by others in speaking. On imitating the sound the errors in movement are detected and corrected by comparing the resulting sound with the sound heard. The sounds then that are most distinctly pronounced and requiring movements that are the most clearly visible will naturally first be learned and be most clearly pronounced. Those made in the front part of the mouth, such as labials and dentals, fulfil both of these conditions, while those made in the back part of the mouth usually fulfil neither of them. This law, if approximately true, must yet be modified by the fact that children can usually make every one of the elementary sounds used in language before they begin to talk. The difficulty in pronouncing a word is not to utter the elementary sounds of which it is composed, but to properly combine them. As in learning other complex series of motions, it is not a question of making any one motion, but of properly co-ordinating a series of simple motions. No one has any difficulty in pronouncing such words as "three," and "gray," and "geese" separately, but many do in pronouncing them rapidly one after the other. For a similar reason a child who can pronounce perfectly a sound in one word is wholly unable to utter it in another. Besides this, sounds are modified somewhat by the sounds that precede and follow them. Almost every one also slurs some sounds in his pronunciation, and children frequently notice and try to imitate only the most distinctly pronounced sounds. They therefore often mispronounce, not from inability to utter the sounds, but because they have failed to notice some of the less perfectly pronounced ones. Since sounds made at the beginning of words are least modified by other sounds, mispronunciation can best be studied in the initial sounds of words. The letter with which a word begins usually, but not always, indicates the sound. The following is the order for the letters appearing most frequently as initial letters in children's vocabularies: s, b, c, p, t, w, d, m, h, f, r, l, g, n. To understand the significance of this, it must be compared with the order of frequency for the difficult letters in the dictionary (s, p, c, a, t, b, r, m, d, f, e, h, l, g), and in "Robinson Crusoe" (s, c, p, a, f, b, r, m, e, t, w, h, l, i, g). One of the most marked differences is the greater number of words beginning with the dentals *b* and *d* to be found in the vocabularies of children.

Many very interesting questions were suggested by the study of the records already sent me, but a much larger number of vocabularies must be compared before reliable answers can be obtained. I shall be glad to receive such records at any time, or to communicate with any one in regard to methods of carrying on the study of children. Letters directed to Rhodes, Iowa, will always reach me.

E. A. KIRKPATRICK.

Rhodes, Io., Sept. 14.

The Convection Theory of Storms.

DR. HANN of Vienna has published recently an extended discussion of this subject, and one which has the extremest significance (Sitzber. d. kais. Akad. d. Wissensch. in Wien, April, 1891). He reiterates his view that in our storms at heights of 10,000 feet there is a fall in temperature, and a corresponding rise in our high areas. These points have been sufficiently answered already (*Science*, Vol. XVI., p. 136). The remaining discussion merits our attention, as it presents a rather strong attack upon the theories ordinarily accepted. A free translation of the argument is here given. Dr. Hann says:

"How can we think that such extremely flat disks as the great storms of the higher latitudes are can maintain themselves and advance through a rising of air particles. Our whirls have often more than a hundred times greater extension horizontally than vertically. Doberck gives this ratio as 250:1. A chimney, as is well known, draws only when its height is many times greater than its interior diameter. But in our whirls the relation is in a most extreme manner opposite. How such an exceedingly flat air-disk, only through an interior force, that is, through a freeing of latent heat by a local interior moisture condensation, can move itself in the atmosphere, appears to me difficult to understand. The whole height of the atmosphere (so far as it can come into consideration for the condensation theory) at the utmost is small as compared to the horizontal diameter of our whirl (above 25,000 feet is there no moisture). I do not know that the convection theory has seriously considered this objection. This objection does not hold against the theory that correlates the whirl with disturbances in the general circulation currents of the atmosphere.

"A fact which stands out in sharp contradiction with the plain convection theory of our storms lies in the yearly period of their frequency and intensity. If the convection theory is clearly applicable to most of our storms, how can it be that these storms have their greatest intensity and frequency in the winter, even at a time of the year when the conditions, as well for their origin as for their continuance, are most unfavorable?

"In winter the moisture of the air is slight and the thermic equilibrium most stable. Upon the continents the lowest layers are often for a long time the coldest, and the temperature increases above. The heat diminution with height is very small in winter, even less than in a rising air current due to the distribution of moisture. How can a whirl under such conditions of the convection theory reach to the interior of Siberia, where the temperatures are −22° F. to −40° F., and there is no moisture. It is an inevitable consequence of the convection theory that the cyclones of the summer must reach their greatest intensity and frequency, because at this time the moisture of the air is greatest, the heating of the lowest layers the most active, and the heat diminution with height in consequence the most rapid.

"In fact, heat thunder-storms and tropical cyclones, the appearances to which rightly the convection theory can find application, are limited to the warm season. Tropical cyclones reach a maximum of occurrence at a time when the temperature of the sea is highest, or when a generally uniform air pressure and the absence of strong air currents favor largely the development as well as the advance of such whirls, which, perhaps, have for the great part their driving force in themselves. Also the heat thunder-storms or thunder-storm whirls of our summers occur most

abundantly and most intensely, with uniform air pressure, weak winds, a strong heating of the lower air strata, and a high humidity of the air.

"The storms of the temperate latitudes have, moreover, still another peculiarity, outside of their maximum action in the coldest season during a period of the greatest stability in the thermic equilibrium of the atmosphere, which stands in contradiction to the convection theory, namely, a tendency to take the same path one after the other. Upon this peculiarity Köppen has remarked before (Met. Zeit., 1874, Vol. IX., p. 380), and we need only to examine the daily weather charts to find clear examples in abundance.

"This view is wholly contrary to the facts which the true cyclones of the convection theory show, and must show. A cyclone equalizes the temperature above and below in the region through which it passes. The condensation process heats the higher layers, cools off the lower, and makes a more stable equilibrium in the atmosphere. At the same time the moisture of the lower air layers is used up, and at the same place precipitation cannot occur again through pure convection currents. The cyclones of the convection theory must diminish or become extinct, if placed where shortly before another cyclone was in activity which has disposed of the latent energy stored up in the lower layers of the atmosphere in the form of high temperature and great moisture.

"The heat thunder-storms of our summers do not show this peculiarity, and are appearances to which the pure convection theory can find full application. On the other hand, the fact that the cyclones of our latitudes often follow a path behind each other, shows that the convection theory has no application, or only a subordinate one, and that the force upon which their origin and advance depend most importantly is not in themselves, but must be sought outside. We must refer to the conditions of the general distribution of pressure and currents of the general atmospheric circulation for their origin and development.

"If we correlate the origin and forward movement of the cyclones of the temperate and high latitudes with the general circulation of the atmosphere, then the greater frequency and intensity in winter explains itself wholly, as well as all the peculiarities which the application of the pure convection theory contradicts. That also in whirls of this origin the condensation of moisture plays a greater or less secondary *rôle* no physicist can well doubt."

This is a most significant utterance and important attack upon the convection theory. Heretofore this theory has been assailed in England and this country from outside, but now the attack is from within the camp and by one of the foremost of its former defenders. The arguments, to be sure, are rather old, but they are put in a fresh dress. We welcome Dr. Hann to our side of the controversy. It should be noted that, as Miss Clerke has said, the original convection theory has been so added to and corrected it can hardly be recognized. Dr. Hann takes up only one view, and the one applicable to the summer season; but there is another view which applies to the winter, namely, that an unstable equilibrium in the atmosphere may occur whenever, through any reason, a central core becomes heated above its surroundings. This gives a less diminution of temperature with height, instead of greater, as in the other view, and at the same time causes a rising tendency in the air; this has been called the "balloon" effect. Dr. Hann will find that the "chimney" effect has been relegated to the tornado, in which the height is very much greater than the breadth.

There would seem to be no greater difficulty in accounting for the moisture and generation of a storm which follows another than in accounting for these conditions in the first. It is not supposed that a storm carries away very much from any region, but each one may feed upon the conditions which surround it. In fact, there is probably a good deal more moisture in sight and usable after a storm has passed than before, unless the first storm is followed directly by a high area, which is contrary to Dr. Hann's supposition. It does not seem as though these and other more serious objections to the old theory can longer be ignored by convectionists.

H. A. HAZEN.

Washington, D.C., Sept. 21.

BOOK-REVIEWS.

A Girl in the Karpathians. By MENIE MURIEL DOWIE. New York, Cassell. 8°. $1.50.

THAT this is an entertainingly written book of travel few will deny. The region described is one visited little, or we might say not at all, by the ordinary tourist, and the author abandoned herself to a life with the natives for the several months she was in the Karpathians.

That there are many girls like Ménie Muriel Dowie may well be doubted, and perhaps it is as well that there are not. She is certainly bright, but independent almost to a fault. In answer to those asking why she went alone, she writes: "I gaze at their indulgent, smiling eyes, and their self-satisfied faces, and I dare not tell them that I do it from sheer bold preference. I couldn't have the heart to wound and shock them so, and I say, what is perhaps also true, that I am driven to it, for nobody cares to come to the places I care to go to." That there must be a little of self-satisfaction in Miss Dowie's face, one cannot help thinking. There must be some self-reliance at least in a girl of twenty-five, as the author describes herself, who, armed with a revolver and dressed in knickerbockers, plunges into a thinly-settled region for a sojourn of months. She hails from Scotland, but a love for cigarettes does not at all conform with the general conception of a Scottish lassie's character.

But eccentricities can be overlooked in one as clever as Ménie Muriel Dowie, and the interest in her personality adds to the charm of her book. She shows her youth occasionally in the earnestness of her self-communing over the problems of life, but her account of the people she lived with is well worth reading. To be sure she tells us inadvertently that it is the way of returning travellers to swap lies, but the book shows little sign of its being a work of fiction.

AMONG THE PUBLISHERS.

THE next volume of the Contemporary Science Series, published by Chas. Scribner's Sons, will be "The Man of Genius," by Professor Lombroso. This volume, which will be issued on September 25, will be copiously illustrated.

— Messrs. Smith, Elder, & Co. have in preparation "Vertebrate Embryology," by A. Milnes Marshall, F.R.S., professor in the Victoria University, Beyer professor of Zoology in Owens College, late fellow of St. John's College, Cambridge; new, revised, and cheaper edition of Finlayson's "Clinical Manual;" new edition of Farquharson's "Guide to Therapeutics;" new edition of Part I. of MacCormac's "Surgical Operations."

— This year's volume of the Annual of the Office of Naval Intelligence, just issued from the government printing office at Washington, is the tenth in the series of general information from abroad, and retains the title of last year's number, "The Year's Naval Progress." It has a chapter on ships and torpedo-boats, one on machinery, and one each on ordnance, electricity on shipboard, and the naval manœuvres of 1890. Chapter VI. treats of the armor question in its present aspect, as viewed in the light of recent practical tests; and Chapter VII. presents a view of the different systems of coast defence of the various European States. Other chapters are devoted to high explosives, torpedo vessels, and promotion in European navies; and the final chapter gives a list of books on professional subjects.

— Messrs. Sampson Low, Marston, & Co announce: "Theory and Analysis of Ornament," applied to the work of elementary and technical schools, by Francois Louis Schauermann, for eight years head master of the wood and carving department, Royal Polytechnic, Regent Street, with 263 illustrations; "Answers to the Questions on Elementary Chemistry," theoretical and practical (ordinary course), set at the examinations of the science and art department, South Kensington, 1887-91, by John Mills, formerly of the Royal College of Science, London, author of "Alternative Elementary Chemistry," fully illustrated; "Chemistry for Students," consisting of a series of lessons based on the syllabus of the science and art department, and especially designed to facilitate the experimental teaching of elementary chemistry in schools and evening classes, by John Mills, author of "Alternative Elementary

Chemistry," etc., numerous illustrations; "A Complete Treatise on the Electro-Deposition of Metals," comprising electro plating and galvanoplastic operations, the deposition of metals by the contact and immersion processes, the coloring of metals, the methods of grinding and polishing, etc., translated from the German of Dr. George Langbein, with additions by William T. Brannt, editor of "The Techno-Chemical Receipt Book," etc., illustrated by 125 engravings; "Handwriting in Relation to Hygiene," being a paper read at the Seventh International Congress of Hygiene and Demography, London, 1891, by John Jackson, and the report of the commission of specialists appointed by the Imperial and Royal Supreme Council of Health, Vienna, 1891.

— Messrs. Blackie and Son have in the press a "Text-book of Agriculture," under the editorship of Professor R. P. Wright of the Glasgow and West of Scotland Technical College. They have also in preparation a series of "Guides to the Science Examinations" (the first number, which is nearly ready, is by Mr. Jerome Harrison of Birmingham, and deals with the examinations in physiography). Pinkerton's "Mechanics," in their series of science text-books, is about to enter a second edition, and the opportunity is being taken to adapt it to the revised requirements of the 1891 syllabus of the science and art department.

— During the coming winter Mr. Edward Arnold proposes to issue a series of popular papers on animals, by Professor C. Lloyd Morgan, the well-known author of "Animal Life and Intelligence;" "A Treatise on the Standard Course of Elementary Chemistry," by E. J. Cox, head master of the Technical School, Birmingham; and a series of scientific works by Doctor Wormell (the series will embrace text-books of mechanics, sound, light, heat, magnetism, and electricity).

— The following announcements are made by Messrs. Macmillan & Co.: "Essays on some Controverted Questions," by T. H. Huxley, F.R.S.; "Dr. Schliemann's Excavations at Troy, Tiryns, Mycenæ, Orchomenos, Ithaca, Presented in the Light of Recent Knowledge," by Dr. Carl Shuchhardt, authorized translation by Miss Eugenie Sellers, with appendix on latest researches by Drs. Schliemann and Dörpfeld, and introduction by Walter Leaf, illustrated with two portraits, maps, plans, and 290 woodcuts; "Beast and Man in India," by J. L. Kipling, with numerous illustrations by the author; "An Introduction to the Theory of Value," by William Smart; "Public Finance," by C. F. Bastable, professor of political economy, Trinity College, Dublin; "The Pioneers of Science," by Professor Oliver Lodge, with portraits and other illustrations; "Electricity and Magnetism: a Popular Treatise," by Amédée Guillemin, translated and edited, with additions and notes, by Professor Silvanus P. Thompson, with numerous illustrations, uniform with the English editions of M. Guillemin's "The Forces of Nature" and "The Application of Physical Forces;" "Island Life; or, The Phenomena and Causes of Insular Faunas and Floras," including a revision and attempted solution of the problem of geological climates, by Dr. A. R. Wallace, with illustrations and maps, new and cheaper edition; "A Complete Treatise on Inorganic and Organic Chemistry," by Sir Henry E. Roscoe, F.R.S., and Professor C. Schorlemmer, F.R.S., Vol. III. "Organic Chemistry; the Chemistry of the Hydrocarbons and their Derivatives, or Organic Chemistry," six parts, Part VI.; "A Text book of Physiology," illustrated, fifth edition, revised, Part IV. comprising the remainder of Book III. "The Senses and Some Special Muscular Mechanisms," and Book IV. "The Tissues and Mechanisms of Reproduction," by Michael Foster, F.R S., professor of physiology in the University of Cambridge; "Text-book of Comparative Anatomy," by Dr. Arnold Lang, professor of zoology in the University of Zurich, formerly Ritter professor of phylogeny in the University of Jena, issued as the ninth edition of Edward Oscar Schmidt's "Hand-book of Comparative Anatomy," translated into English by Henry M. Bernard and Matilda Bernard, with preface by Professor Ernst Haeckel, 2 vols., illustrated (Vol. I. in October); "Materials for the Study of Variation in Animals" (Part I. Discontinuous Variation), by William Bateson, Balfour student and fellow of St. John's College, Cambridge, illustrated; "The Diseases of Modern Life," by Dr. B. W. Richardson, new and cheaper edition; "Ligation in Continuity," by Drs. C. A. Ballance and Walter Edmunds, with illustrations and plates; "The Dietetic Value of Bread," by John Goodfellow; "On Colour Blindness," by Thomas H. Bickerton, illustrated (Nature Series); "The Geography of the British Colonies" — "Canada," by George M. Dawson, "Australia and New Zealand," by Alexander Sutherland; "The Algebra of Co-Planar Vectors and Trigonometry," by R. B. Hayward, F.R.S., assistant master at Harrow; "The Elements of Trigonometry," by Rawdon Levett and A. F. Davison, masters in King Edward's school, Birmingham; "Progressive Mathematical Exercises for Home Work" (in two parts), by A. T. Richardson, senior mathematical master at the Isle of Wight College, formerly scholar of Hertford College, Oxford; "The Geometry of the Circle," by W. J. McClelland, Trinity College, Dublin, head master of Santry school, illustrated; "Mechanics for Beginners," by the Rev. J. B. Lock, author of "Arithmetic for Schools," etc., Part I. Mechanics of Solids, Part II. Mechanics of Fluids; "A Graduated Course of Natural Science for Elementary and Technical Schools and Colleges," by B. Loewy, examiner in experimental physics to the College of Preceptors, Part II. Second Year's Course; "Methods of Gas Analysis," by Walter Hempel, Ph.D., translated by Dr. L. M. Dennis; "Nature's Story Books," I. "Sunshine," by Amy Johnson, illustrated.

— The Clarendon Press promises "Geography of Africa South of the Zambesi," by W. Parr Greswell; "Mathematical Papers of the late Henry J. S. Smith, Savilian Professor of Geometry in the University of Oxford," with portrait and memoir, 2 vols.; "Plane Trigonometry, without Imaginaries," by R. C. J. Nixon; "A Treatise on Electricity and Magnetism," by J. Clerk Maxwell, new edition; "A Manual of Crystallography," by M. H. N. Story-Maskelyne; "Elementary Mechanics," by A. L. Selby; "Weismann's Lectures on Heredity,' Vol. II., edited by E. B. Poulton, F.R.S.

— In the October *Educational Review* Professor James H. Blodgett, special agent of the census for statistics of education, begins the interpretation of the educational statistics of the Eleventh Census; President Francis A. Walker argues for the higher appreciation of schools of technology; Professor Herbert B. Adams traces the beginnings of university entension in America; and John T. Prince of Massachusetts describes some of his recent experiences in the German schools. Other articles are by Professor Hanus of Harvard, Superintendent Aaron Gove of Denver, Dr. Larkin Dunton of Boston, Professor Hammer of Munich, and the editors. Book reviews are by Sir William Dawson of McGill College, Montreal, Professor B. I. Wheeler of Cornell, Professor Garnett of the University of Virginia, Professors Hyslop and Jackson of Columbia, Professor Sanford of Stanford University, Superintendent Calkins of New York, and the editors. This issue also contains the full text of the English act known as the "Elementary Education Act, 1891," which introduces free education on a large scale.

— The Cambridge University Press announces: "Catalogue of Scientific Papers Compiled by the Royal Society of London," new series for the years 1874–1883; "The Collected Mathematical Papers of Arthur Cayley, Sc.D., F.R.S., Sadlerian professor of pure mathematics in the University of Cambridge," Vol. IV. (to be completed in ten volumes); "A History of the Theory of Elasticity and of the Strength of Materials," by the late I. Todhunter, F.R.S., edited and completed by Karl Pearson, professor of applied mathematics, University College, London — Vol. II. Saint Venant to Sir William Thomson;" "A Treatise on Elementary Dynamics," new and enlarged edition, by S. L. Loney, fellow of Sidney Sussex College; "Solutions of the Examples in a Treatise on Elementary Dynamics," by the same author; "A Treatise on Thermo-dynamics," by J. Parker, fellow of St. John's College, Cambridge; "A History of Epidemics in Britain," Vol. I., from A.D. 664 to the extinction of plague in 1666, by Charles Creighton, M.D., formerly demonstrator of anatomy in the University of Cambridge; "Catalogue of Type Fossils in the Woodwardian Museum, Cambridge," by H. Woods, of St. John's College, with preface by Professor T. McKenny Hughes; "Examination Papers for Entrance and Minor Scholarships and Exhibitions in the Colleges of the University of Cambridge" — Part I. Mathematics and

Science, Part II. Classics, Mediæval and Modern Languages, and History (Michaelmas Term, 1890), Part III. Mathematics and Science, Part IV. Classics, Law, and History (Lent Term, 1891); and three volumes in the Pitt Press Mathematical Series — "An Elementary Treatise on Plane Trigonometry for the Use of Schools," by E. W. Hobson, fellow of Christ's College, Cambridge, and university lecturer in mathematics, and C. M. Jessop, fellow of Clare College; "Arithmetic for Schools," by C. Smith, master of Sidney Sussex College, Cambridge; "Solutions to the Exercises in Euclid, Books I.–IV.," by W. W. Taylor.

— A portrait of James Russell Lowell, made from a recent photograph, forms the frontispiece of the September *Writer*, which is a Lowell memorial number. The magazine opens with an article on "Lowell in Private Life," by John H. Holmes of Cambridge, brother of Oliver Wendell Holmes, and for years an intimate social companion of Mr. Lowell. Following this are personal tributes to Mr. Lowell, written at the request of the editor of the *Writer*, by Francis Ellingwood Abbott, C. A. Bartol, James Parton, Laurence Hutton, George Makepeace Towle, Thomas Nelson Page, Frank R. Stockton, Edward Everett Hale, N. P. Gilman, Edward Eggleston, Lucretia P. Hale, Edwin Lassetter Bynner, Margaret J. Preston, Agnes Repplier, Ernest Ingersoll, Arthur Gilman, George Parsons Lathrop, Oscar Fay Adams, James Jeffrey Roche, W. H. Furness, Louise Imogen Guiney, Joel Benton, Thomas S. Collier, Danske Dandridge, Lucy Larcom, Arlo Bates, Sylvester Baxter, Noah Brooks, Kate Field. An interesting comparison between Lowell and Matthew Arnold is made by Edward T. McLaughlin, assistant professor of English at Yale College. The *Writer* is working, in the interest of writers, for a reduction of postage rates on manuscripts, which now go at letter rates.

— J. B. Lippincott Company have published "The Natural History of Man," by Alexander Kinmont, being a series of lectures originally delivered and published some fifty years ago. The author was a Scotchman by birth and education, but settled in the United States when a young man, and labored here as clergyman and teacher. The subjects of the lectures are certain phases of human nature and human history, such as the races of mankind, the origin and uses of language, the predominance of the religious sentiment in early ages, the elements of American civilization, etc., all of which are treated from a religious point of view. There is no unity of plan in the book, so far as we can discover; but many of the topics are well handled, though without any striking originality. The distinguishing characteristic of the book is a simple and unaffected piety, which in these days of skepticism and half-hearted belief is refreshing. The moral tone of the lectures is also excellent, and the style is easy and flowing, though somewhat diffuse. The author's science and history are sometimes at fault, and there are passages in the book which could not have been written at the present day; yet to persons of a religious temper these lectures will be a source of interest and profit.

— Messrs. Longmans, Green, & Co. announce a new volume of "Fragments of Science: being Detached Essays, Addresses, and Reviews," by John Tyndall, F.R.S.; "About Ceylon and Borneo: being an Account of Two Visits to Ceylon, One Visit to Borneo, and how I Came Home and was Rocked to Sleep on the Bosom of — well, 'The Suez Canal,'" by Walter J. Clutterbuck, author of "The Skipper in the Arctic Seas," and joint author of "Three in Norway," and "B.C. 1887," with illustrations; "Anthropological Religion," the Gifford lectures delivered before the University of Glasgow in 1891, by F. Max Müller; "An Introduction to Human Physiology," being the substance of lectures delivered at the St. Mary's Hospital medical school from 1885 to 1890, by Augustus D. Waller; "Elements of Materia Medica and Therapeutics," with numerous illustrations, by C. E. Armand Semple, M.R.C.P. Lond., member of the Court of Examiners, and late senior examiner in arts at Apothecaries' Hall, etc.; "Outlines of Theoretical Chemistry," by Lothar Meyer, professor of Chemistry in the University of Tübingen, translated by Professors P. Phillips Bedson and W. Carleton Williams (this book, of about 200 pages, gives a concise account of the theories of modern chemistry, which, it is expected, will not only be of use to advanced students, but will also enable those who take a general interest in science, but are unfamiliar with the details of chemical investigation, to gain a general idea of the development of theoretical chemistry); "The Dynamics of Rotation," by A. M. Worthington, professor of physics, and head master of the Dockyard School, Portsmouth; "The Principles of Chemistry," by D. Mendeléef, professor of chemistry in the University of St. Petersburg, translated by George Kamensky, A.R.S.M. of the Imperial Mint, St. Petersburg, and edited by A. J. Greenaway, sub-editor of the Journal of the Chemical Society, 2 vols.; "A Manual of the Science of Religion," by Professor Chantepie de la Saussaye, translated by Mrs. Colyer Fergusson (*née* Max Müller), revised by the author; "Solutions: being an English translation (by M. M. Pattison Muir) of Book IV. Vol. I. of the second edition of Ostwald's 'Lehrbuch der allgemeinen Chemie.'"

— Messrs. A. and C. Black have in preparation: "Manual of Chemistry," by Dr. Alexander Scott, Durham; "Manual of Botany," by Dr. Scott, Bickley; "Dictionary of Birds," by Professor Alfred Newton and Dr. Gadow.

— Among the contents of the current number of the "Proceedings of the United States Naval Institute" are "Explosives and Ordnance Material," by S. H. Emmens; "The Effect of Waterline Damage on the Stability of Unarmored War-ships," by Charles Hemje; "Naval Reserve and Naval Militia," by Lieut. J. C. Soley, U.S.N.; "The Final Improvement of the Steam-Engine," by Dr. R H. Thurston; and the usual amount of professional and bibliographical notes.

— Among the most notable of standard and miscellaneous works announced by D. Appleton & Co. for publication will be Père Didon's "Life of Christ," in two volumes, with maps and forty-eight full-page illustrations; the third volume of Professor J. B. McMaster's "History of the People of the United States;" a new edition of Herbert Spencer's "Essays," with additions, in three volumes; "The Life of James Boswell" (two volumes), by Percy Fitzgerald, with four portraits; "Lady Dufferin's Journal of her Life in Canada," illustrated; "The Cause of the Ice Age," by Sir Henry Ball; "Man and the Glacial Period," by Professor G. Frederick Wright; "The Farmer's Side," by Hon. W. A. Peffer, United States Senator from Kansas; "Herbart's Psychology," translated by Margaret K. Smith; "The Courses of Study for Schools and Colleges," by W. T. Harris, United States commissioner of education; "Applied Psychology and Art of Teaching," by J. Baldwin; "Laboratory Practice," by Professor J. P. Cooke; and "The Dog in Health and Disease," by Wesley Mills, M.D.

— Amid all the wild speculation that is floating about just now respecting the overflow of the Colorado River into the desert, it is instructive to read such an article as the one in the October *Scribner* on "The New Lake in the Desert," by Major J. W. Powell, Director of the United States Geological Survey, who brings to the subject a thorough knowledge of natural conditions, and overthrows many extravagant theories both as to the past and future of the phenomenon. J. N. Hall, M.D., a hunter of experience, has an article in the same number of unique interest and of practical value to all sportsmen, on "The Actions of Wounded Animals;" and in an interesting article on "The Biography of the Oyster," whose life history we have hardly before properly appreciated, Mr. Edward L. Wilson, the well-known traveller and photographer, gives the following figures as representing the work of but one of the important centres of the oyster industry, "The Delaware Bay and Maurice River Cove Oyster Association" of New Jersey. In the fall of the year, when the business is at its height, from thirty to forty car-loads leave there daily, each one carrying away 100 sacks or barrels of oysters averaging 1,000 oysters. Thus from 3,000,000 to 4,000,000 are shipped daily.

— According to Bulletin No. 14 of the Iowa Agricultural Experiment Station, the clover seed caterpillar (*Grapholitha interstinctana*), which is described and figured in different stages, has been abundant and detructive, and the conclusion is reached that cutting the clover and storing it while the caterpillars are still in the clover heads results in the entire destruction of the insect. The same bulletin states that experiments with hopper dozers for grass-leaf hoppers show that this method can be used very suc-

cessfully in capturing the insects; that the simplest form, a flat piece of sheet-iron, was most satisfactory; that one application resulted in adding thirty-four per cent to the crop of hay on a plat experimented on, and at one experiment leaf-hoppers were captured at the rate of 376,000 per acre. Kerosene emulsion for plant lice was used once with poor success, but later an application of a good emulsion by thorough methods resulted in complete success. Grasshoppers are mentioned as troublesome this season, and reports of Rocky Mountain grasshoppers are referred to. No present damage to Iowa is apprehended from this latter species, and methods of controlling the common native species, when numerous, are discussed. The flavescent clover weevil is found abundant at Ames. Its distribution is referred to and its method of work described. Information regarding its occurrence in other parts of the State is requested. The wheat-bulb worm has occurred in moderate numbers, but abundant parasites have been found to attack it at Ames, and its serious multiplication is not considered probable.

— M. E. Heckel of Marseilles has recently described an interesting case of mimicry which may be frequently seen in the south of France. The mimic, *Nature* states, is a spider, *Thomisus onustus*, which is often found in the flowers of *Convolvulus arvensis*, where it hides itself for the purpose of snaring two Diptera, *Nomioides minutissimus* and *Melithreptus origani*, on which it feeds. Convolvulus is abundant, and three principal color variations are met with: there is a white form, a pink one with deep pink spots, and a light pink form with a slight greenishness on the external wall of the corolla. Each of these forms is particularly visited by one of three varieties of *Thomisus*. The variety which visits the greenish form has a green hue, and keeps on the greener part of the corolla; that which lives in the white form is white, with a faint blue cross on the abdomen, and some blue at the end of the legs; the variety which lives in the pink form is pink itself on the prominent parts of the abdomen and legs. If the animal happens to live on *Dahlia versicolor* the pink turns to red, and if it lives in a yellow flower — *Antirrhinum majus*, for instance — it becomes yellow. At first Professor Heckel supposed the three varieties of *Thomisus* to be permanent, but he discovered accidentally that any one of these peculiarly colored spiders, when transferred to a differently colored flower, assumes the hue of the latter in the course of a few days; and when the pink, white, green, and yellow varieties are confined together in a box, they all become nearly white.

— During the nesting season the male ostrich seems to be anything but an agreeable creature. In a paper lately read before the Royal Society of Tasmania (*Nature*, Sept. 10), Mr. James Andrew says that at that period the bird is most pugnacious, and may only be approached in safety with great precaution. He resents the intrusion of any visitors on his domain, and proves a most formidable opponent. His mode of attack is by a series of kicks. The leg is thrown forwards and outwards, until the foot, armed with a most formidable nail, is high in the air; it is then brought

Publications received at Editor's Office, Sept. 16–22.

BAILEY, L. H. Annals of Horticulture in North America for the Year 1890. New York, Rural Publ. Co. 312 p. 8°. $1.

DAVIS, G. G. Anales de la Oficina Meteorologica Argentina. Tomo VIII. Climas de Chacra de Matanzas, Corrientes, Catamarca, Mailin, y Cochinoca. Buenos Ayres, Coni é Hijos. 569 p. f°.

DAVIS, J. Woodbridge. Theoretical Astronomy: Dynamics of the Sun. (Woodbridge School Essays, No. 1.) New York, Woodbridge School. 97 p. 4°.

EMTAGE, W. T. A. An Introduction to the Mathematical Theory of Electricity and Magnetism. (Clarendon Press Series.) New York, Macmillan. 228 p. 12°. $1.90.

OCCULTISM, the Key of Nature. Vol. I. No. 1. Boston. 16 p. 4°.

RICHTER, V. von. Chemistry of the Carbon Compounds; or, Organic Chemistry. 2d ed. Philadelphia, Blakiston. 1040 p. 8°. $3.50.

WEISMANN, A. Essays upon Heredity and Kindred Problems. Vol. I. 2d ed. New York, Macmillan. 471 p. 8°. $2.

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